

Western Electric Co., Incorporated,  
Equipment Engineering Branch, Hawthorne.

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Issue 2 BT-53007-01  
November 16, 1926.  
Replacing all previous  
issues. 53007-01  
51502277-  
BT 502173-

This M. of O. was prepared from Issue 3 of Drawing ST-53007-01

#### METHOD OF OPERATION

Selector Circuit - Incoming From Special "A" Switchboard - Three Wire  
Dialing - Panel Machine Switching System.

#### DEVELOPMENT

##### 1. PURPOSE OF CIRCUIT

- 1.1 The purpose of this circuit is to intercept a busy line through an associated final selector under "no test" conditions. Having intercepted the busy line, the circuit must remain in the talking position and shall not return to normal until the intercepted line is normal.

##### 2. WORKING LIMITS

- 2.1 This circuit is limited, as to external subscriber's line loops with which it may be connected, to the operating limits of the (T) and (T-1) test relays. All other operating conditions are local.

#### OPERATION

##### 3. PRINCIPAL FUNCTIONS

The principal functions of this circuit are:

- 3.1 Selection of a final selector arranged to await release from the subscriber's switchhook.
- 3.2 Selection of a final selector arranged to release from the subscriber's line after a predetermined time.
- 3.3 Connect to a busy line "no test" without the use of the "no test" key by the operator. (The "no test" key will be removed from the position equipment when this circuit is specified.)
- 3.4 When the intercepting operator removes the cord plug from the trunk jack disconnection will be delayed when any one of the following conditions are present on the intercepted line:
  - (a) Dial tone to subscriber.
  - (b) Subscriber dialing.
  - (c) Subscriber talking, 24 volt transmission.
  - (d) Subscriber talking, 48 volt transmission.

*See modification  
SKN 4816*



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issues.

- See modification SKN 4816*
- (e) Incoming selector ringing called subscriber.
  - (f) Sender making preliminary coin test.
  - (g) Sender collecting or returning coins.
  - (h) Subscriber attached to trunk to zero operator's position.
  - (i) Subscriber attached to a two number toll cord.
  - (j) Final making switchhook test.

3.5 Will permit disconnection only when the called line is normal.

3.6 Automatically applies the "no test" to the final selected without the use of the "no test" key.

#### 4. CONNECTING CIRCUITS

4.1 Any standard zero operator's position cord circuit.

4.2 Any standard final selector that does not revert impulses over the ring.

4.3 Dialing incoming sender circuit ES-239433.

#### DESCRIPTION OF OPERATION

##### 5. SEIZURE

When the intercepting operator tests the jack associated with this circuit and, finding it idle plugs the cord into the jack, the circuit may be said to be seized. The (SL) relay will operate from battery on the sleeve of the cord, windings of (SL) relay in series, to ground on the R cam. The (PLS) relay will also operate over the tip and ring of the cord, 500 ohm resistance to ground on the "S" cam. The operation of the (SL) relay lights the busy lamp at the position jack. The operation of the (PLS) relay operates the (REL) relay, and it, in turn, the (L) relay removing the switch from position 1 to position 2, selecting sender.

##### 6. THOUSANDS REGISTRATION

While the function of selecting the sender is in progress thousands registration of the required subscriber's number may be made. In position 1 3/4 of the switch a circuit is closed from ground back contact (PLS) relay, D cam, front contact (REL) relay, back contact (TR) relay, winding (ADV) relay to the (TH) stepper. The (TH) stepper will respond to the number of pulses received from the (PLS) relay, the (PLS) relay



operating in response to the dial pulses determined by the thousands digit dialed by the operator. It will be seen that when the (TH) register moved off normal ground was applied from the (TH-B) arc to the winding of the (TR) relay. The (TR) relay is shunted however, by ground from the front contact (REL) relay, front contact (ADV) relay, non-inductive winding (TR) relay. This shunt is maintained until all the pulses for any given digit are received after which the (ADV) relay releases, permitting the (TR) relay to operate. The (TR) relay operated, transfers the pulses from the (PLS) relay for the subsequent digits to the sender for registration.

#### 7. SENDER SELECTION

When the (L) relay operated, moving the switch from position 1 to position 2, a circuit from the winding of the (P) relay to ground on the front contact of the (L) relay was established operating the (P) relay. The (P) relay operated, applied ground from its left hand armature and front contact, front contact (L) relay, H cam, to the (SS) stepper, and the sender selector is now hunting an idle sender. When the (L) relay operated, a test circuit was established from the 1200 ohm winding, front contact, cam 0, to the bridging test brush of the (SS-A) arc. If the terminal on which the test brush rests is busy, there will be ground which will hold the (L) relay operated, and the (SS) switch will step to the next terminal, continuing this until an idle terminal is found, that is, the absence of ground. Finding the terminal idle, the (L) relay is released, applying a make busy by way of the T cam, back contact (L) relay, to test brush of the sender selector, and also moved the switch from position 2 to position 3. In position 2 3/4 ground from the S cam, right hand front contact (P) relay, operated the (CI) relay. The (CI) relay operated, connected the (TH) register to the sender for the purpose of transferring the registration to sender relays, and also transferred the pulse lead from the (PLS) relay to the sender. When the first pulse of the hundreds registration is received in the sender, the sender sequence switch moves from position 1 to position 2, and in position 2 ground is applied to the CI lead, (SS) arc F, contacts (CI) relay, to (CI-1) relay which operates. The (CI-1) operated, in turn operates the (CI-2), and the incoming selector circuit is now ready to make brush selection.

#### 8. BRUSH SELECTION

In position 3, the (L) relay is operated over the FT and FR leads, to the sender and ground on the I cam, moving the switch from position 3 to position 4. A hold circuit for the (L) relay is provided by way of the right front contact and (M) cam, to the sender. The UP drive



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magnet is energized and the A commutator segment closed to the sender. As the brush support moves upward, impulses are sent into the sender from the A commutator segment, shunting the (STP) relay of the sender. When the impulses required for the particular brush selection determined by the register relay setting, have been sent into the sender, the (L) relay releases, and the switch moves to position 5. In position 5 the trip magnet (TRIP) is energized ready to trip the brush selected upon the next upward movement of the brush support for group selection.

#### 9. GROUP SELECTION

In position 5 the FT and FR leads are again closed from the (L) relay, the sender and the I cam, operating the (L) relay, moving the switch from position 5 to position 6. In position 6 group selection takes place controlled by the B commutator segment and the sender register setting, in a similar manner to what was the case for brush selection. The UP drive magnet is energized, the brush support moves upward, reveritive impulses are sent into the sender and group selection takes place. On completion of the required selection the (L) relay releases and the switch moves to position 7.

#### 10. TRUNK HUNTING

In position 7, the (L) relay operates to ground at the P cam, moving the switch to position 8. A test circuit is applied from the (L) relay front contact, I cam, to the sleeves of the trunks of the trunk group selected. The UP magnet is energized and the brush support moves upward over the terminals of the trunks. If the first trunk is idle the (L) relay will release as the switch leaves position 7 1/4, and a busy ground will be applied to the trunk from the T cam, back contact (L) relay, I cam to sleeve of trunk. The switch will move to position 9. Should the first trunk be busy, the (L) relay will be held operated, and as the brush support moves upwards the successive trunk sleeve terminals will be tested. Finding one of the terminals idle, the (L) relay winding connected to the sleeve will be deenergized but will not release until the C commutator segment opens. The C segment circuit is from the 800 ohm winding of the (L) relay, P cam, C commutator, G commutator feed brush, front contact (L) relay. This circuit is for the purpose of centering the brush on the particular terminal found idle. On release of the (L) relay the switch moves to position 9, and a local circuit again operates the (L) relay and the switch moves to position 10, selection beyond.



11. SELECTION BEYOND

When the (L) relay operated in position 9, a locking circuit was found from the front contact of the (L) relay, G cam, to the final selector circuit. At the same time the 800 ohm winding was closed to the final by way of the L, M and G cams as well as a 500 ohm resistance to battery. The windings of the (L) relay together with the 500 ohm resistance, all of which are in parallel, is the "no test" feature of this circuit. This condition is applied to the final selector to cause it to attach itself to the called line "no test". The final selector tip is extended to the sender, and selections are made in the usual manner. After final selections, are completed, the (L) relay releases, and the switch moves to position 14, talking.

12. SENDER DISMISSAL

When this circuit advances from position 10, the (PLS) relay is released. The (PLS) relay released, in turn released the (REL) relay, the (P) relay, (CI) relay (CI-1) and (CI-2) following in succession. The release of these relays dismissed the sender.

13. CALLING CORD SLEEVE RESISTANCE CHANGE OVER

When the intercepting trunks, used "without no test" advance from position 11 to the talking position, a change over in the sleeve resistance is made so that talking battery can be supplied to the called subscriber's telephone. This is arranged by opening the 466 ohm winding of the (SL) relay. This reacts in the cord circuit to operate relays that apply the required talking battery. This feature is made part of this circuit although not used, the condensers preventing interference with the condition on the called line.

14. TRUNK RELEASE

*See Modification SKN 4816*  
In position 14 of this switch, after the operator has determined in condition obtaining on the called subscriber's line, release of the trunk can follow. On removal of the cord plug from the trunk jack the (SL) relay releases, applying ground from the N cam, back contact (SL) relay, E cam, to the 149-L interrupter. On closure of the B interrupter contact the (W) relay will operate, closing the windings of the (T) and (T-1) relays to ground. If the line called is busy, either the (T) or the (T-1) relay will operate. When the



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B contact opens, the (Z) relay operates in series with the (W), maintaining the (T) and (T-1) relays closed to ground. When the F interrupter contact closes, due to either the (T) or the (T-1) relays being operated, the (W) relay will be released, and when the F contact opens the (Z) relay will release. This cycle of events repeats until the called line is normal in which condition the (T) or (T-1) relays cannot operate, and the (Z), (W) relay combination is held operate. With the (Z) and (W) relays operated the closure of the B interrupter contact now operates the (L) relay and from this point the switch is returned to normal.

15. CONDITIONS OF TEST

The (T) and (T-1) relays must operate and prevent release of the trunk when any one of the following conditions is present on the called line:

- 15.01 If the line connected to is talking, supplied by 24 volt for transmission from the incoming selector, disconnection must be delayed.
- 15.02 If talking, 48 volt transmission, disconnection must be delayed.
- 15.03 If the subscriber is listening to dial tone, disconnection must be delayed.
- 15.04 If dialing, disconnection must be delayed.
- 15.05 If incoming selector is ringing called line, disconnection must be delayed.
- 15.06 If operator is ringing called line, disconnection must be delayed.
- 15.07 If sender is making preliminary coin test, sender must not be interfered with and disconnection must be delayed.
- 15.08 If sender is collecting or returning coins disconnection must be delayed.
- 15.09 If subscriber is calling zero operator disconnection must be delayed.
- 15.10 If line connected to is attached to a two number holding cord, disconnection must be delayed.



16. CHANGE OVER OF MEANS OF TEST

If the final used "no test" with the intercepting trunk is attached to a line on which a final is awaiting release from the subscriber's switchhook, and the line loop is of low resistance, the (T) or the (T-1) relays will not operate, and to prevent disconnection, the switch is advanced from position 14 to position 16. In 14 3/4 a closure to the tip of the trunk from the (L) relay is effected. This holds the relay operated to ground in the final selector circuit awaiting subscriber's switchhook release. Should the line loop resistance, when the final on the called line is awaiting switchhook release, be above a given value, the (T) and (T-1) relays function and the switch is held in position 14.

17. OVERFLOW

Should all trunks of a trunk group be busy at the time the switch is trunk hunting the brush support will continue to the overflow terminal of the group, the (L) relay will release, and due to the fact that the Z commutator segment is now closed the switch will advance to position 17. In position 17, the tip and ring of the cord is closed through the 500 ohm resistance and #160 interrupter which will flash the cord lamp, informing the operator of the condition present.

18. TELL-TALE

Should the brush support move to the tell-tale position during any one of the selecting periods, for any reason, the switch will advance to position 17, the overflow position and information will be given the operator by the flashing supervisory lamp.

19. ABANDONED CALLS

If the operator should abandon the call when this circuit is in the brush or group selection positions, ground from the back contact of the (REL) relay, D cam, M cam and the (L) relay, will send the brush support, to tell tale, release of the circuit will follow in the usual manner. During selection beyond, if the call is abandoned before the final has completed selections, the ground from the (REL) relay is used to send the final to tell-tale.

ENG: C.W.H.  
November 16, 1926.  
MS

CHK'D BY: G.E.H.

APPROVED E. R. COOKE



CHANGE OVER OF MAINS OF TEST

If the final used test with the interlocking trunk is attached to a line on which a final is awaiting release from the subscriber's switchhook, and the line loop is of low resistance, (T) or the (T-1) relays will not operate, and to prevent disconnection, the switch is advanced from position 1A to position 1B. In 1A 2/4 a closure to the tip of the trunk from the (L) relay is effected. This holds the relay operated to ground in the final selector circuit awaiting subscriber's switchhook release. Should the line loop resistance, when the final on the called line is awaiting switchhook release, be above a given value, the (T) and (T-1) relays function and the switch is held in position 1A.

OVERFLOW

Should all trunks of a trunk group be busy at the time the switch is trunk hunting the brush support will continue to the overflow terminal of the group. The (L) relay will release, and due to the fact that the 2 commutator segment is now closed the switch will advance to position 1V. In position 1V, the tip and ring of the cord is closed through the 500 ohm resistance and 4500 inductor which will flash the cord lamp, informing the operator of the condition present.

SELF-TALK

Should the brush support move to the self-talk position during any one of the selecting periods, for any reason, the switch will advance to position 1V, the overflow position and information will be given the operator by the flashing supervisory lamp.

ABANDONED CALL

If the operator should abandon the call when this circuit is in the brush or group selection position, ground from the back contact of the (REL) relay, D cam, M cam and the (L) relay, will send the brush support, to tail cable, release of the circuit will follow in the usual manner. During selection beyond, if the call is abandoned before the final has completed selection, the ground from the (REL) relay is used to send the final to tail-cable.



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Issue 3 BT 54001-01  
Appendix 1  
April 3, 1929.

This Appendix was prepared from Issue 40 of Drawing ST-54001-01.

METHOD OF OPERATION

For Miscellaneous Alarm Circuits - Appearing On Floor Alarm Board - Panel System.

Add the following paragraph:-

36. AUD. ALARM SW. FUSE ALARM

36.1        Operation of a floor alarm board or main alarm board fuse connects battery to operate relay (FAF) which lights the alarm board fuse lamp (FA), lights the trouble desk. When the operated fuse is removed, relay (FAF) releases, restoring the circuit to normal.

ENG: E.L.B.  
April 3, 1929.  
AR

CHK'D: E.L.B.

APP'D: L. T. MARKS  
F.R.E.



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Western Electric Co., Incorporated,  
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For Miscellaneous Alarm Circuits - Appearing on Floor Alarm Board - Panel  
System

Add the following paragraph:-

26. ALARM SW. PUSH ALARM

26.1 Operation of a floor alarm board or main alarm board fuse connects battery to operate relay (YAP) which lights the alarm board fuse lamp (YA). Lights the trouble desk. When the operator releases, relay (YAP) releases, restoring the circuit to normal.

APP'D: J. T. HARRIS  
V.R.E.

CHK'D: E.L.D.

ENG: E.L.D.  
April 5, 1929.  
AR